REMARKS

The applicant respectfully requests reconsideration of the subject application in view of the amendments attached hereto and the following remarks.

In paragraph 2 the Examiner indicates that claims 33, 34, 35, 58 and 59 are withdrawn from further consideration as being directed to a non-elected species. These claims are herewith amended to depend from claim 1. It should be noted that step (1) of claim 33 before amendment was identical with claim 1, and consequently the amendment to claim 33 effected herewith does not alter the scope of claim 33.

As a consequence claim 58 is now redundant and is cancelled.

In paragraph 5 the Examiner objects to the wording of claim 37. Claim 37 is herewith amended in order to traverse this objection. The subject matter thereby deleted has been appended as new claim 60.

Additional, minor amendments to the claims have also been made to improve the clarity of the claims, but without adding any subject matter.

In paragraph 7 the Examiner rejects claims 1, 35 and 37 under 35 U.S.C. 103(a) as being unpatentable over *Hold et al.* (US Patent No. 4,311,446) taken together with *Hillman et al.* (US Patent No. 5,470,218).

Claim 1 of the present application includes three key features, referred to for convenience as steps (A), (B) and (C):

(A) Inspecting parts for defects, and reducing injection stroke in response to any flashing or increasing injection stroke in response to any short shots (i.e. step (2));

(B) Inspecting parts for defects, and reducing injection velocity in response to any flashing or increasing injection velocity in response to any short shots (i.e. step (3)); and

(C) Employing step (3) after step (2) if step (2) is found to have substantially no effect, or step (2) after step (3) if step (3) is found to have substantially no effect.

The Examiner contends that steps (A) and (B) are disclosed by *Hold et al.*; the Examiner directs the applicant's attention specifically to column 1 lines 17 to 20, column 2 lines 4 to 6, column 5 lines 16 to 27 and column 13 line 15 to column 14 line 34.

However, despite the Examiner's intention, none of these passages— read alone or in combination—discloses step (A) or (B).

With respect to step (A), the passages of *Hold et al.* cited by the Examiner do indeed refer to adjusting "shot volume" and controlling screw stroke. However, *Hold et al.* fail to teach the fundamental features of step (A), that is, inspecting parts for defects, and reducing injection stroke in response to any flashing or increasing injection stroke in response to any short shots. Rather, *Hold et al.* teach, from column 13 line 28 to column 14 line 7, that screw stroke should be adjusted either because the ram is detected to have stopped "prior to desired final cushion set point because the mold then is full" [column 13 lines 57 and 58] or because the ram "passes the indicated final cushion set point approaching a bottoming out" [column 13 lines 62 and 63]. In each case the response taught by Hold is to alter the "screw recharge position" so as to reduce or enlarge the shot size, respectively.

The approach of *Hold et al.* may thus be summarized as observing final ram position and in response altering screw recharge position. The approach of step (A) of the present application may be summarized as observing a molded part (not final ram position) and in response altering injection stroke (not screw recharge position). There is thus no teaching in *Hold et al.* of the procedure of step (A).

The applicant appreciates that, from column 5 line 12, *Hold et al.* discuss inspecting a molded part (whether by computer or by a human operator) and relating defects in the part to "the necessary changes to the set points of the various control variables" [column 13 lines 25 and 26], but this passage is discussing a speculative "future development" [column 13 line 13] and, in any event, makes no reference to the particular defects referred to in step (A) or the responses to those defects defined in step (A).

Similarly, *Hold et al.* fail to disclose step (B). The Examiner contends that step (B) is disclosed at column 9 line 60 to column 10 line 6 and column 11 lines 1 to 36. However, these passages refer to "screw speed", not to injection velocity. Indeed, the cited passages are found in the "Melt Temperature Control" section of *Hold et al.* (beginning at column 9 line 39), so a discussion of screw speed—which is used in controlling melt temperature—is entirely appropriate.

Screw speed and injection velocity, however, are not the same quantity. The distinction between these parameters can be readily understood by reference to figure 1 of *Hold et al.* Injection moulding machine 2 has a screw 8 that can be rotated by means of a "source of rotary motion 1" (typically an electric motor) and driven laterally by means of "screw back pressure motor means 14" (typically a hydraulic ram); "screw speed" is the *rotary* speed of the screw (as employed during the plastication phase or stage), whilst "injection velocity" is the *lateral* velocity of the reciprocating screw (as employed during the injection stage or phase). The distinction between the plastication and injection stages is discussed in the present application from page 2 line 18.

That is, when the melt is being prepared, electric motor 12 is used so that material loaded into feed hopper 18 is driven to the right (as seen in figure 1) by the Archimedes-screw action of screw 8. The material is mixed and heated as it is advanced by the rotary motion of screw 8 (hence undergoing plastication), and accumulates forward of screw 8 prior to commencement of the injection phase. It is important that this plastication phase be conducted with suitable parameters, so that the resulting melt is homogeneous in density, composition and color. Defects in these properties, however, do not relate to the subsequent injection phase, as they concern the quality of the melt and will often not be readily apparent (and certainly not as flashing or as a short shot) in the ultimate molded product.

Hence, the cited passages refer to controlling plastication parameters (including "screw speed"), *not* to injection phase parameters (including "injection velocity").

Thus, it is submitted that *Hold et al.* do not disclose the inspection of moulded parts for flashing and short shots and, in response, the adjustment of injection velocity, as defined in step (B) of claim 1.

It should also be borne in mind that the present invention concerns the optimisation of the setting-up of an injection molding machine (i.e. prior to a production run), a traditionally time-consuming and labor-intensive procedure that is discussed, in particular, from page 5 line 24 of the present application. *Hold et al.* are in fact principally concerned with the fine-tuning of injection moulding machine parameters once a production run is underway. Accordingly, *Hold et al.* propose a closed loop system in which initial screw position and speed (amongst other parameters) can be adjusted continually as manufacturing proceeds. As *Hold et al* state in their abstract: "Control of the injection moulding *process* is achieved through an event requisition velocity..." [emphasis added]. Such fine-tuning is important, but has no bearing on the "setting-up" of the injection moulding machine *before* production commences. *Hold et al* are concerned with the continual adjustment of parameters during production, not with how those parameters are initially established. The present invention is concerned with the latter, so *Hold et al* is of little if any relevance to the present application.

The Examiner then contends that the portion of step (C) described by the Examiner as "performing the other step after the one step is found to have substantially no further effect" is merely to apply the control interface of *Hillman et al.* However, the applicant—though he has considered *Hillman et al.* in detail—cannot locate any such teaching. Dr Speight concludes that the Examiner's assertion that "adjustment of the set points is inputted and stored and used in the monitoring activity but the reference set points are entered again to match the new actual set point" appears to relate most closely to the passage from column 11 line 61 to column 12 line 5. This passage explains that, once reference set points have been stored, subsequent changes to the set points do not lead to any change in the reference set points *unless* the user re-enters the reference set points manually. However, this passage merely teaches that reference set points should not usually be changed, even if the actual set points are varied. This is understandable, as the reference set points relate to a specific configuration program and would normally require little if any adjustment. Indeed, "alarm

limit values" are used so that, should a user alter the set points from the reference set points by more than an acceptable amount, an alarm message will be displayed in alarm field 1038.

Thus, this passage concerns the preservation of optimal or "reference" set points and the avoidance of unauthorised variation from such set points; it does not in any way teach the performing of another step after the one step is found to have substantially no further effect.

It is submitted, therefore, that *Hillman et al.* fail to disclose a procedure comparable to step (C) wherein two distinct optimisation procedures (step (2) and step (3) are employed in reducing essentially one type of defect (i.e. flashing/short shots) observed in a molded product. Consequently, it is submitted that the combination of *Hold et al.* and *Hillman et al.* cannot provide all the features of claim 1, nor render claim 1 obvious.

One must also question whether the person of ordinary skill would combine the teachings of *Hold et al.* and *Hillman et al.* in the manner suggested by the Examiner. As discussed above, the most pertinent aspects of *Hold et al.* concern a "multivariable computer control system" (FMC) discussed from column 5 line 12. However, as *Hold et al.* concede, the FMC is merely a "future development"; the FMC had not been developed—and is not described other than speculatively—when the application granted as US 4,311,446 was filed. The skilled person, upon reading that the FMC was merely a "future development" and not a reality (whether on paper or prototype) would be prompted to look elsewhere for such a system. If, as foreshadowed by *Hold et al.*, an FMC was subsequently developed, the skilled person would surely turn to that *actual* development. No evidence of such a development, however, has been presented. Thus, the relevant portion of *Hold et al.* is merely speculation concerning some future, proposed development, so it is questionable whether *Hold et al.* has any merit as a prior disclosure.

In any event, the skilled person would be hard-pressed to combine the speculation of *Hold et al.* with the system detailed by *Hillman et al.* This is particularly apparent when one considers that *Hold et al.* filed their application in 1974, almost twenty years before *Hillman et al.* filed their application. In the intermediate period, advances in injection molding technology rendered the disclosure of *Hold et al.* of minimal value and, consequently, the

skilled person would be unlikely to consult *Hold et al.* It is indeed noteworthy that *Hold et al.* was not cited against *Hillman et al.*

Thus, it is submitted that claim 1 is patentable over the cited accommodation of prior art documents.

In paragraph 9 the Examiner cites the same combination of documents against the patentability of claims 36 and 37. The Examiner contends that *Hillman et al.*, in the referenced passage, teach time interval subgroups for operating an input set point adjustment and the monitoring or graphing of response to determine further adjustment. This is simply not the case. As it is explained in the present application from page 20 line 31, the injection molding machine's velocity control response time is determined according to the present invention from a velocity profile obtained during the setting-up procedure. This may be compared with the prior art approach in which a value of response time provided by the manufacturer of the injection moulding machine is used.

To clarify this distinction, claim 36 is herewith amended to refer to "*measuring* a velocity control response time" rather than merely "determining a velocity control response time". No cited document discloses "measuring a velocity control response time", as a part of a setting-up procedure (as in the present invention) or otherwise.

In view of the novelty of how response time is determined according to the present invention, it is not surprising that *Hillman et al.* in fact fail to disclose any technique or apparatus for determining a response time. The reference passage refers to figure 20, which includes a graph 402 of a "selected processing parameter". The processing parameter is selected by means of the icons in regions 330, 332, 334, 336 and 338 of display 100 in figure 17 (see column 18 lines 14 and 15). The processing parameter icons in regions 330, 332, 334, 336 and 338 are extensive but do not include "injection velocity", even amongst those in region 332 relating to "Injection Parameters". Consequently, *Hillman et al.* do not teach that injection velocity can be displayed in graph 402, so graph 402 cannot be used to determine response time.

In any event, graph 402 is not a straightforward plot of the selected parameter. Rather, as is discussed from column 17 line 43, each subgroup in graph 402 comprises "a set of currently compiled data from a selected number of consecutive machine cycles". A typical subgroup is said to include data from six machine cycles. Thus, graph 402 is configured to display a statistical measure (e.g. an average) of a selected parameter, not the selected parameter itself. Even if graph 402 could display injection velocity (though *Hillman el at.* teach that it cannot), the graph would remain incapable of displaying instantaneous values of injection velocity as a function of time, from which an accurate response time could be determined.

Further, the Examiner contents that graph 402 is used for monitoring a response to the adjustment of an input set point, to determine further adjustment. Even if this is so, it must be remembered that response time is a largely machine-dependent property that is not "adjusted" in the course of the setting-up process or during a particular production run. The type of feedback provided by a graph such as that shown in figure 20—which is displayed *during* the production run—is redundant in the determination of response time.

Thus, it is submitted that claim 36 is novel and inventive over the cited combination of prior art documents.

In addition, the Examiner contends that the second limb of claim 36, which defines "employing time steps greater than the velocity control response time" would have been obvious in hold in view of the teaching of *Hillman et al.* However, *Hillman et al.* make no reference to response time and, as it is apparent from the above discussion, does not disclose any mechanism for determining a response time, so this contention is not supported by the disclosure of *Hillman et al.* Indeed, neither of the cited documents makes any reference to "response time", nor to setting time steps empirically on the basis of the observed performance of an injection moulding machine.

Accordingly, it is again submitted that claim 36 is not rendered obvious by the cited accommodation of documents.

With respect to claim 37 (now comprising amended claim 37 and new claim 60), there is also no reference in the cited documents to setting the time steps to 1.5 or 2 times the response time or indeed, to setting the time steps on the basis of any observed quantity (whether of the molding machine or the molding process). The Examiner may feel that, in hindsight, such time steps are obvious, but this contention is not supported by the cited documents. Accordingly, it is submitted that claim 37 as amended and new claim 60 are patentable over the cited art.

Favorable reconsideration is respectfully requested.

Respectfully submitted,

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